

(51) International Patent Classification⁶:

B26F 1/26

A1

(11) International Publication Number:

WO 98/12028

(43) International Publication Date:

26 March 1998 (26.03.98)

(21) International Application Number: PCT/SE97/01556

(22) International Filing Date: 15 September 1997 (15.09.97)

(30) Priority Data:

9603422-8

19 September 1996 (19.09.96)

SE

(71) Applicant (for all designated States except US): NEOS
ROBOTICS AB [SE/SE]; Ritar slingan 22 A, S-187 66
Täby (SE).

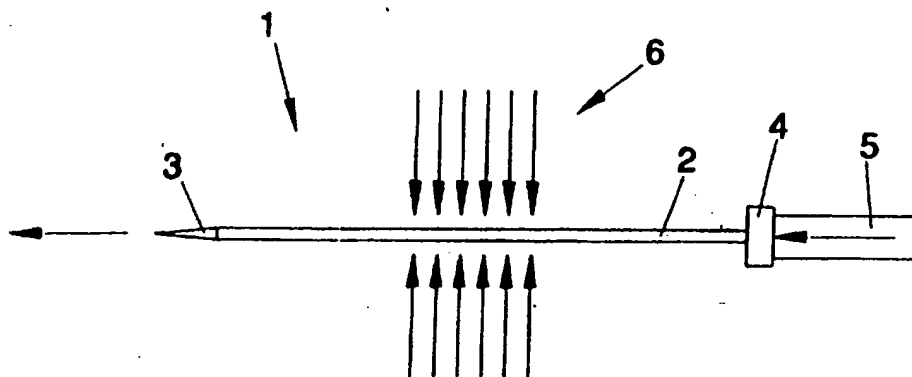
(72) Inventor; and

(75) Inventor/Applicant (for US only): NEUMANN, Karl-Erik
[SE/SE]; Nyängen 2076, S-760 15 Gräddö (SE).(74) Agent: H.W. BARNIESKE PATENTBYRÅ AB; P.O. Box 25,
S-151 21 Södertälje (SE).(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR,
BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE,
GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK,
LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO,
NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR,
TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH,
KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ,
BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE,
CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL,
PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN,
ML, MR, NE, SN, TD, TG).

Published

With international search report.

(54) Title: A METHOD AND MEANS FOR HOT-AIR CUTTING



(57) Abstract

A method for hot-air cutting wherein compressed air is forced into a hot-air unit (2) in which the compressed air is heated, whereafter the air is conducted out through a cutting nozzle (3) in the form of hot air and a device for hot-air cutting, wherein a compressed-air unit is connected to a hot-air unit (2) via a coupling device arranged at one end of the hot-air unit (2) to provide the hot-air unit (2) with compressed air, the hot-air unit (2) being provided at its other end with a cutting nozzle (3), and also wherein a heating device (6) is arranged to heat air flowing into the hot-air unit (2).

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

A method and means for hot-air cutting

TECHNICAL FIELD:

The present invention relates to cutting and working technology using
5 hot air.

BACKGROUND ART:

Previously known methods for cutting various types of plastics such as
foam plastic, moulded plastic and other porous materials such as
10 textiles use laser technology which has the drawback that the material
is burned. Ultrasound is also used to cut these types of material but has
the drawback of being imprecise and "spongy". High-pressure water
jets are also used for cutting textiles but produce a messy edge.
Electronic beam working also occurs in which electrons are thrown out
15 from a cathode consisting of a tungsten wire, through a hole in an
anode, subsequently adjusted magnetically and then concentrated by a
magnetic lens. A working temperature of about 6000°C is reached with
this technology and electronic beam working is an unnecessarily
complicated technology for the materials for which the present
20 invention is suitable.

OBJECT OF THE INVENTION:

The object of the present invention is to provide a method and a device
for cutting and, to a certain extent, also working porous material such
25 as foam plastic, moulded plastic and textiles, said method solving the
problems of previously known methods and being simple, inexpensive
and reliable.

SUMMARY OF THE INVENTION:

30 Using compressed air which is forced into a heated tubular channel
provides a hot-air jet which is forced out of a cutting nozzle at high
pressure, this hot-air jet being used to cut and, to a certain extent work
porous material such as foam plastic, moulded plastic and textiles.

BRIEF DESCRIPTION OF THE DRAWINGS:

The invention will now be described in more detail with reference to the accompanying drawings.

5 Figure 1 shows a basic diagram of a device and a method according to the present invention.

Figure 2 shows a section through a device with inductive heating according to the present invention.

10 Figure 3 shows a section through a device with electric heating according to the present invention.

DESCRIPTION OF THE INVENTION:

Figure 1 illustrates the principle of the present invention in which a cutting tool 1 comprising a hot-air unit 2 is provided at one end with a cutting nozzle 3. The hot-air unit 2 is provided at its other end with a coupling device 4 arranged to connect a compressed-air hose 5 to the hot-air unit 2. When the compressed-air hose 5 has been connected to the hot-air unit 2 compressed air can flow into the hot-air unit 2, through this and out through the cutting nozzle 3, as indicated by arrows in Figures 1-3. A heating device 6 is also arranged in connection with the hot-air unit 2 in order to heat the air in the unit. In the embodiment of the invention illustrated in Figure 1, the arrows directed at right angles to the hot-air unit 2 may be represented by a burner, not shown, which heats the hot-air unit with an open flame.

25 The range for the operating pressure out through the cutting nozzles is 1-100 bar, depending on the material to be cut. The pressure of the air entering the hot-air unit 2 may be 6-20 bar, for instance, whereas the pressure out through the cutting nozzle will be in the order of 50 bar.

30 The heating device 6 is arranged to heat the air flowing into the hot-air unit 2 to a temperature which can be set depending on the material to be cut or worked. For foam plastic, for instance, a temperature of about 200°C is used and for moulded plastic a temperature of about 1000°C.

The cutting nozzle 3 is detachably connected to the hot-air unit 2 so that it can be replaced with a different nozzle particularly suited to textiles, for instance, or in the case of damage or wear.

5 According to one embodiment of the invention shown in Figure 2, the heating device 6 is in the form of an inductive heater, placed on the heating section 7 of a certain stretch along the hot-air unit 2. Upon inductive heating the heating section 7 is enclosed by an inductive
10 heater 8 in the form of a coil supplied with high-frequency alternating current. The frequency of the current is chosen depending on the heating desired. If the frequency is increased, heating will be concentrated to the layer closest to the outer surface of the heating section 7, whereas a lower frequency will produce heating further into the material. The heating is obtained by a rapidly alternating magnetic
15 field which passes through the heating portion 7 and produces eddy currents in the material. The current losses heat the hot-air unit 2 and the air therein. An embodiment in which the heating section 7 is removed is also feasible within the scope of the invention. The high-frequency alternating current is produced in generators operating in the
20 frequency range 4-30 Mp/s for power factors up to 100 kW.

Figure 3 shows another embodiment in which the hot-air unit 2 is in the form of a coil, in which case the heating device 6 consists of a resistive electric heater 9.

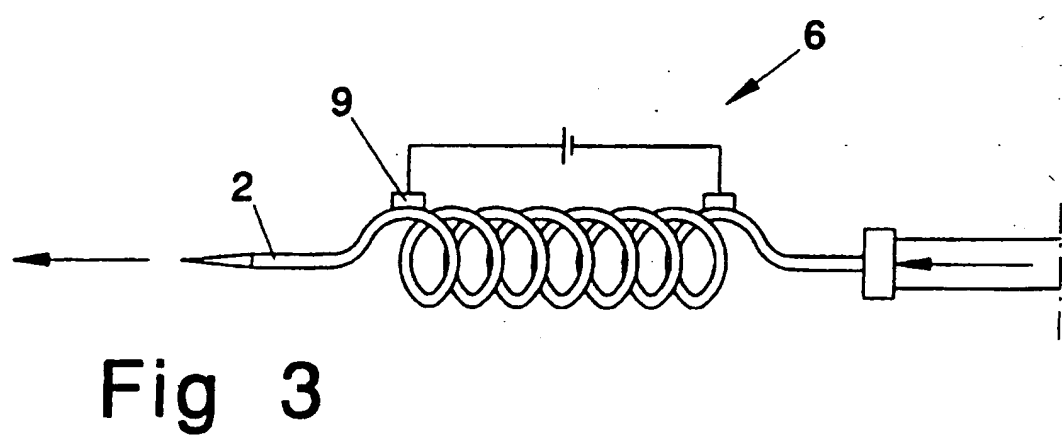
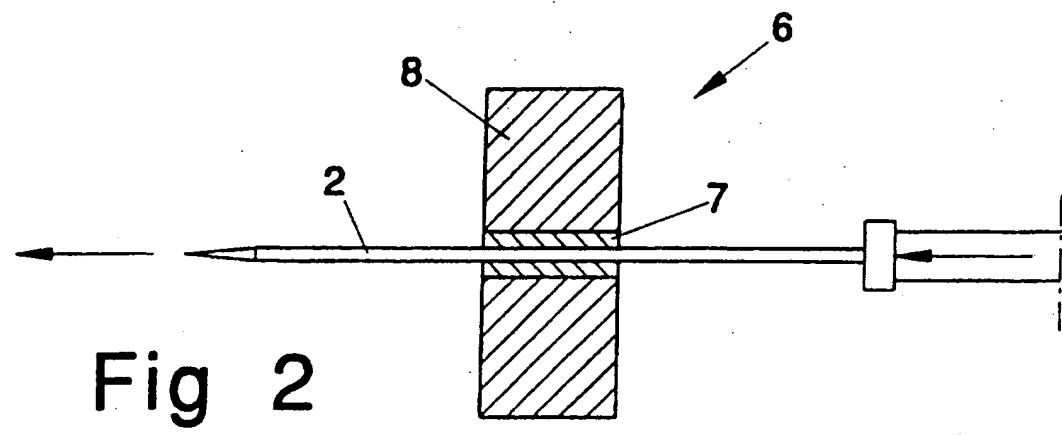
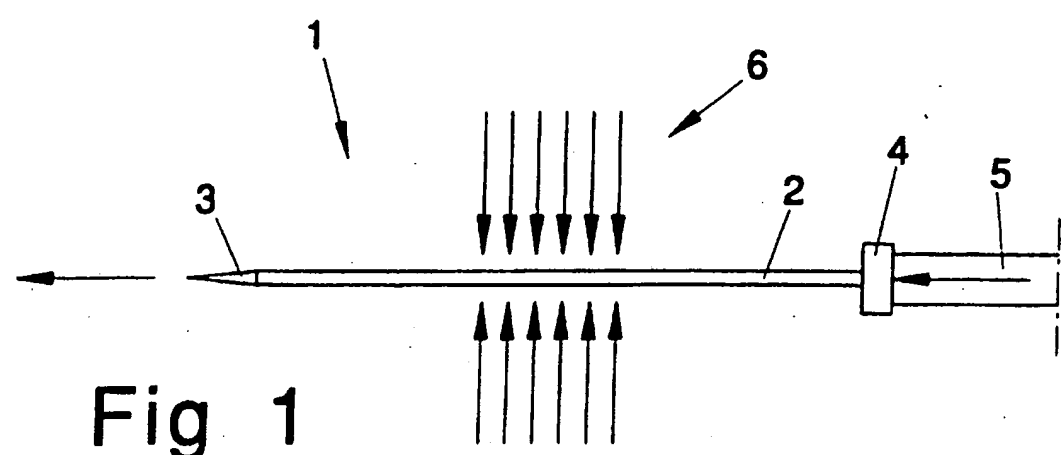
25 In all the embodiments described above, the hot-air unit 2 is shaped as a cylindrical tube of acid-proof steel having uniform diameter along its axial extension. Its cutting nozzle has an out-flow opening with a diameter of approximately 0.01 - 2.00 mm, i.e. equivalent to a gas
30 welding nozzle.

The hot-air unit can be shaped in several advantageous ways within the scope of the following claims, e.g. with varying diameter in order to achieve a different degree of compression on the nozzle side.

CLAIMS

1. A method for hot-air cutting, characterized in that compressed air is forced into a cylindrical hot-air unit (2) in
5 which the compressed air is heated, whereafter the air is conducted out in the form of hot air through a cutting nozzle (3) which has an outflow opening with a diameter of 0.01 - 2.00 mm..
2. A method as claimed in claim 1, characterized in
10 that the hot-air unit (2) is heated by directly heating an area of the hot-air unit (2) with a burner.
3. A method as claimed in claim 1, characterized in
15 that the hot-air unit (2) is heated by heating an area of the hot-air unit (2) with an inductive heater (8).
4. A method as claimed in claim 1, characterized in
that a heating section is heated by means of electric heating.
- 20 5. A device for hot-air cutting, characterized in that a compressed-air unit is connected to a cylindrical hot-air unit (2) via a coupling device arranged at one end of the hot-air unit (2) to provide the hot-air unit (2) with compressed air and that the hot-air unit (2) is provided at its other end with a cutting nozzle (3) having an outflow
25 opening with a diameter of 0.01 - 2.00 mm, and also that a heating device (6) is arranged to heat air flowing into the hot-air unit (2).
6. A device as claimed in claim 5, characterized in
that the heating device (6) comprises a burner.
- 30 7. A device as claimed in claim 5, characterized in
that the heating device (6) comprises an inductive heater (8).
8. A device as claimed in claim 5, characterized in
35 that the heating device (6) comprises an electric heater (9).

1/1



A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B26F 1/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B26F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EDOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 2508064 B (UNION CARBIDE CORP), 4 Sept 1975 (04.09.75) --	1-8
A	GB 851473 A (THE KENDALL COMPANY), 19 October 1960 (19.10.60) -- -----	1-8

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

16 December 1997

Date of mailing of the international search report

08-01-1998

Name and mailing address of the ISA/
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer

Tycho Beckman
Telephone No. +46 8 782 25 00

02/12/97

PCT/SE 97/01556

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2508064 B	04/09/75	AR 202064 A	09/05/75
		AU 7852775 A	26/08/76
		BE 825958 A	25/08/75
		BR 7501117 A	30/11/76
		CA 1046726 A	23/01/79
		CH 603421 A	15/08/78
		DK 40275 A	05/12/75
		FR 2261858 A,B	19/09/75
		GB 1500365 A	08/02/78
		JP 949445 C	27/04/79
		JP 50119877 A	19/09/75
		JP 53030753 B	29/08/78
		NL 7502217 A	28/08/75
		SE 407533 B,C	02/04/79
		SE 7502108 A	27/08/75
		US 3979494 A	07/09/76
		US 4015917 A	05/04/77
GB 851473 A	19/10/60	GB 851053 A	00/00/00